

Fluid Mechanics.

11/10/2015
سكنين (10) ميكانيكا موائع
AMR
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(5)

* **Fluid** :- any substance that deforms continuously under application of shear stress, no matter how small shear stress may be.

هي أي مادة تتشكل باستمرار تحت تأثير إجهادات القص. معادلات هذا الإجهاد هي غير.

* Mechanics

هو العلم الذي يختص بدراسة سلوك المواد تحت تأثير القوى المختلفة.

dynamics

$$\Sigma F = ma$$

static

$$\Sigma F = 0.$$

* **Fluid Mechanics** :- هو العلم الذي يهتم بدراسة المواد التي تتشكل تحت تأثير إجهاد القص وذلك مع القوى المختلفة.

* **Fluid static** :- $\Sigma F = 0$

* **Fluid dynamics** :- $\Sigma F = ma$

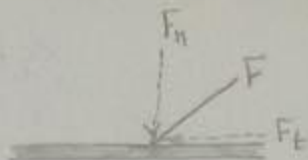
* Application of Fluid Mechanics.

↳ breathing - blood flow - pump - turbine - Fan

boiler - river - ships -

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* $\text{stress} = \frac{F}{A}$



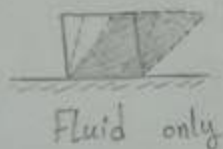
* $\text{normal stress} = \frac{F_n}{A}$

• (pressure) القوة العمودية على السطح

* $\text{Tangential stress} = \frac{F_t}{A}$

• (shear stress) القوة المماسية للسطح

1 Difference between (solid - Fluid)



* حيث يحدث المواد الصلبة
تشويه كبير

2 Difference between (solid - liquid - gas)



المسافات البينية لذرات صغيرة جداً
قوى الترابط بينهم كبيرة جداً



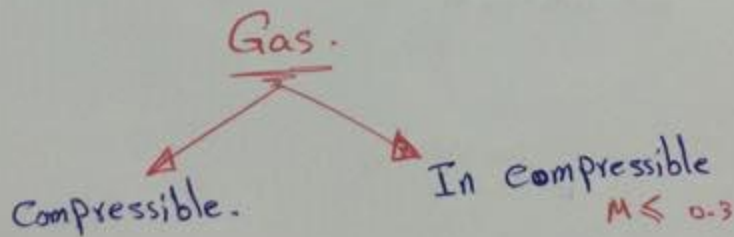
المسافات البينية لذرات كبيرة
نسبياً وقوى الترابط بين
الذرات متوسطة



المسافات البينية لذرات
كبيرة جداً وقوى ترابط
بين الذرات صغيرة
جداً

* Difference between (liquid and gas)

	Liquid	gas
① * distance between Molecules. المسافة بين الجزيئات	Very small	very Large
② * Compressibility الانضغاطية	difficult to compress.	easy to compress.
③ * volume.	has a Fixed volume it takes the shape of the container.	Not Fixed volume it expand to Fill the container.
④ * Free surface.	✓	X

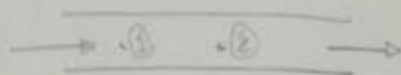


Mach number $\rightarrow (M) = \frac{V}{a}$ سرعة المائع $\rightarrow V$
سرعة الصوت $\rightarrow a$

- * $M=1 \rightarrow (V=a) \rightarrow$ sonic Flow.
- * $M<1 \rightarrow (V<a) \rightarrow$ sub sonic Flow.
- * $M>1 \rightarrow (V>a) \rightarrow$ super sonic Flow.

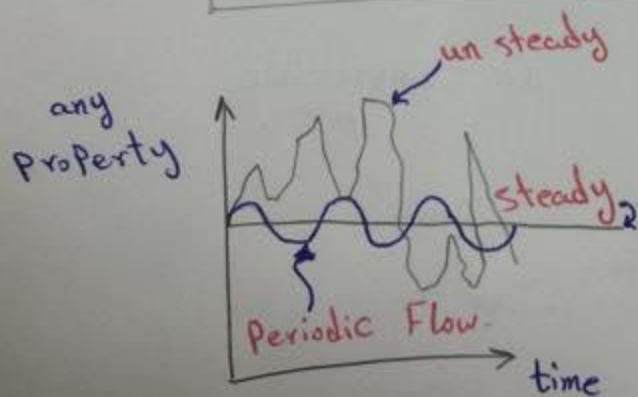
d)

* steady Flow : الخصائص للسريان لا تتغير مع الزمن.



* uniform Flow : الخصائص لا تتغير مع المكان.

	①	②	any property
steady uniform.	50 50 50	50 50 50	↓ تغير مع الزمن
steady non uniform.	50 50 50	60 60 60	↓
un steady uniform.	50 60 90	50 60 90	↓
un steady non uniform.	50 70 100	100 120 130	↓



Sheet (1)

Introduction and Basic Concepts

1- Fill in the blanks with suitable words:

- a) Fluids cannot withstand shear stress.
- b) Fluids have ability to deform when a shear force is applied.
- c) The atoms/molecules are easy to move in fluids.
- d) In liquids the rate of strain is proportional to shear stress.
- e) The difference between liquids and gases is compressibility.
مرونة السوائل ← قابلية الانضغاط
- f) Liquids form a Free surface when in a container.
- g) Gases expand to fill the container.
- h) The distance between molecules is highest in Gas.
- i) The three phases of matter are solid - liquid - gas.
- j) A special state of matter at high temperatures is plasma.
- k) Fluid mechanics: The science that deals with the behavior of fluids at rest (Fluid static) or in motion (Fluid dynamic), and the interaction of fluids with solids or other fluids at the boundaries.
- l) In analyzing the behavior of fluids, there are two such entities are defined namely compressible and the Incompressible.
- m) A volume defined in space through which fluid may flow with varying mass and volume is called a system, and its boundaries called boundary.

Introduction and Basic Concepts

2- Define ~~Micro~~compressible flow and incompressible ~~fluid~~ ^{Flow}. Must the flow of a compressible fluid necessarily be treated as compressible?

3- Define stress, normal stress, shear stress, and pressure.

$$F/A$$

$$F/A$$

$$F/A$$

$$F/A$$

4- Fluids at rest cannot resist a shear stress. Explain with examples.

5- Distinguish between vapour and gas.

6- When is a system a closed system, and when is it a control volume?

7- What is a steady-flow, uniform flow, and periodic flow process?

8- What is the importance of modeling in engineering?

9- Provide and discuss examples of fluid mechanics engineering applications. List four differences between liquids and gases. Give examples for each matter.

10- A number of common substances are

Tar - Sand - Silly Putty - Jello - Modeling clay - Toothpaste - Wax - Shaving cream - Ketchup - Glycerin - Wall Paints

Some of these materials exhibit characteristics of both solid and fluid behavior under different conditions. Explain.